

## A METHOD AND DEVICE FOR REEL TRANSPORT

This invention regards a method of reel transport. More particularly it regards a method of transporting an empty reel of the type equipped with outer peripheral tracks and which is typically used for transport and storage of relatively heavy coiled bodies. The invention also regards a device for implementation of the method.

When shipping long, coilable bodies such as pipes, so-called umbilicals or coiled tubing used in petroleum production, it is common for the long body to be coiled on a drum of considerable size. The package weight may be in the hundreds of tons, with a reel diameter of the order of 10 meters and a reel width in excess of 5 metres.

In the following, the long, coilable body is denoted a "pipe".

Transporting pipes on reels of this kind of size and weight is a relatively costly operation, not only because the reel and pipe together represent a substantial weight but also because the geometry of the reel makes it difficult to stow, lift and secure the package efficiently. Thus the reel must be placed in a cradle or similar to hold it safely in place

during transport. In some cases transport across relatively long distances requires the use of a special vessel.

It has turned out that the cost of shipping an empty reel of this type can approach that associated with shipping the reel.

The object of the invention is to remedy the disadvantages of prior art.

The object is achieved in accordance with the invention, by the characteristics stated in the description below and in the following claims.

By constructing the reel so that it may be split into suitable sections for storage and transport in a packed-up form, preferably in standard shipping containers, the costs associated with the storage and transport of empty reels may be reduced significantly.

Reducing the volume of ordinary empty reels is known *per se*. Thus US patent no. 5 242 129 describes a cable drum comprising a cylindrical portion and end flanges, where the end flanges are removably attached to the cylindrical portion.

US patents 5 649 677 and 5 588 628 regard cable drums equipped with two disc-like end flanges, where the end flanges are interconnected by articulated stays. In the unfolded position the stays form the mid section of the reel, and the stays are arranged to be folded up to bring the end flanges closer together when the reel is empty.

Prior art deals with dismountable and collapsible cable drums of a size that allows them to be transported on an ordinary lorry.

Even when scaled up, dismountable or collapsible cable drums according to prior art are not suited for use in the size range described in this invention.

Reels for the object of this invention will during winding and unwinding be placed in a cradle, which is equipped with running wheels and generally also driving wheels. The wheels of the cradle rotate about axes that are parallel to the axis of rotation of the reel, the end flanges of the reel each being equipped with a peripheral rolling surface abutting the wheels of the cradle. The rigidity and strength of the reel must be sufficient to accommodate the torque that would arise if the driving wheel of one half of the cradle were to stop while the driving wheel of the other half of the cradle rotates. These torsional forces may become quite substantial with full loading on the drum.

The smallest reel diameter may be in the order of 5 metres. Obviously it is an advantage if the cylindrical central section of the reel can also be split into smaller sections.

In a preferred embodiment the cylindrical central section is divided into segments of a cylinder interconnected in a separable manner, the end portions of which are removably attached to the end flanges.

Preferably the end flanges are constructed in a way that allows the cylinder segments to be disposed at more than one distance from the central axis of the reel. In this manner it becomes possible, by arranging a sufficient number of cylinder segments at the outer attachment points of the end flanges, to transport pipes with a relatively large minimum bend radius, e.g. 3.5 metres.

The following describes a non-limiting example of a preferred embodiment illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of a reel mounted on the wheels of a cradle;

Figure 2 shows the reel of figure 1, but here the cylinder segments of the reel are arranged at a greater distance from the centre of the reel;

Figure 3 is a perspective view of a triangular flange portion and a segment of a flange, which together form a flange sector of the end flange of the reel;

Figure 4 is a perspective view of a cylinder segment;

Figure 5 is a plan view of two cylinder segments bolted together;

Figure 6 shows the screw-bolt-joint of figure 5 on a larger scale;

Figure 7 shows an alternative screw-bolt-joint seen from the inward facing side of the cylinder segments;

Figure 8 is a perspective view of two cylinder segments fitted with over centre locks;

Figure 9 shows the over centre lock in figure 8 on a larger scale; and

Figure 10 shows parts of a reel placed in a standard 40-foot open container.

In the drawings, reference number 1 denotes a reel comprising two disc-like end flanges 2, 2' and a cylindrical central portion 4 extending between the end flanges 2, see figure 1.

The disc-like end flanges 2, 2' are provided with encircling peripheral rolling surfaces 6 arranged to rotate on the wheels 8 of a cradle (not shown). Each end flange 2, 2' is provided with a plurality of inner notches 10 distributed along a pitch circle about the central axis of the reel 1, and a plurality of outer notches 12, the notches 12 being distributed along a pitch circle having a greater radius than that of the pitch circle for the inner notches 10.

The end flanges 2, 2' are composed of a plurality of triangular flange portions 14 and flange segments 16, see figure 3, where one triangular flange portion 14 and one flange segment 16 are bolted together by means of splices 18 to form an end flange sector 20. Four end flange sectors 20 bolted together form an end flange 2, 2'. Each end flange 2, 2' has a central through opening 22 fitted with driving lugs 24. The driving lugs 24 are arranged to take up the torque from a central driving mechanism (not shown).

The cylindrical central portion 4 is constituted by a plurality of cylinder segments 30 interconnected by means of dovetail connections 32. The ends of the cylinder segments 30 are equipped with a plurality of fastening hooks 34, see figure 4, that match the notches 10, 12 in the end flanges 2, 2'. A latch pin 36 is arranged to slide into a bore (not shown) in the end flanges 2, 2' to prevent the fastening hooks 34 from falling out of the notches 10, 12.

By placing the fastening hooks 34 of the cylinder segments 30 in the inner notches 10, see figure 1, the reel 1 can be prepared for receipt of as long a piping length as possible, while the reel 1 is adapted to pipes having a greater minimum

bend radius by placing the fastening hooks 34 in the outer notches 12, see figure 2.

In an alternative embodiment the cylinder segments 30 are fastened together by means of screw-bolt-joints 38, see figures 5 and 6.

In a further embodiment, see figure 7, the cylinder segments 30 are clamped together by means of an eye bolt connection 40.

An over centre clamping device 42 for holding the cylinder segments 30 together is shown in figures 8 and 9, where the cylinder segments 30 are equipped with guide pegs 44 and corresponding peg holes (not shown).

The sections 14, 16 and 30, which form part of the reel 1, may advantageously be constructed so as to fit into a standard shipping container.

Figure 10 shows a plurality of flange segments 16 and a plurality of cylinder segments stowed into a 40-foot shipping container 46.